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NOTES ON COLLECTING CICINDELIDÆ.

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Read before the Academy, at Manhattan, November 27, 1903.

FOR the past three years my chum, LeRoy Rauch, and I have collected and carefully studied the habits of the species of this family, especially those found in the vicinity of Topeka.

In the spring of 1901, about the 8th of March, we took our first specimens of *Cicindela splendida* and *amœna*, on a clay bank at the edge of timber, and throughout March, April and May we found *repanda* and *vulgaris* common in sandy fields near the river.

In the early part of June we enjoyed a week of most successful collecting on Middle creek, near Ottawa, Kan. There, among numerous other species, we found *C. sexguttata* in its many forms; first on a rocky, wooded bluff on the east bank of the creek, and later throughout the woods, especially along the unused roads and wood paths. Those taken were all green, bearing not the least tendency toward the blue form, violacea. A few types were taken. Early in the morning, when the underbrush in the woods was wet with dew, these insects, being unable to fly, were easily taken as they ran through the grass. But as the day advanced and the grass dried they became more active, so that by ten o'clock they would take wing with ease. A single *splendida* and a few *repanda* were taken there on the creek bank.

Upon our return home on the 15th of June, the sand-bars in the Kaw river, which had been slightly flooded during our absence, were covered with a thin layer of wet mud, and with numerous pools of water. Around the pools, and where the mud was wettest, *ponderosa*, *cuprascens*, and *macra* swarmed. They were all difficult of capture; *ponderosa* because of its extreme wariness, and the other two because of the fact that they fly so close to the ground. These three species remained numerous on the sand-bars for the rest of June, July, and August, a few stragglers staying into September. On account of the very high water during the two following years, 1902 and 1903, these species have not since been taken here in such plenty.

In addition to these we found a form of *formosa*, familiar to eastern Kansas collectors, intermediate between *formosa* and *generosa*, common in sandy fields on the first bottom of the Kaw. With it we found *punctulata*, and a form of *scutellaris* approaching *lecontei*. The *formosa* variety remained common the rest of the summer and autumn, while the *scutellaris* variety soon disappeared, but reappeared again in September, and flourished from then till frost.

These species of *Cicindela*—*punctulata*, *cuprascens*, and *macra*—are found quite often in eastern Kansas at electric lights; but a fourth kind, *lepida*, is a rare visitant at the lights, and is seldom seen by day. On the evening of June 22 I took at the arc lights at Topeka three specimens of this beautiful white insect, the first I had seen. A few more were taken under like conditions in July.

July 4 was spent at Lakeview, near Lawrence, where we found *macra* in extreme abundance along the edge of the lake. With it we found *repanda*, plentiful as usual, and a single specimen each of *duodecimguttata* and *vulgaris*, the last rather out of season. We also found *punctulata* and *formosa* var. on sand by the station.

On the 12th of July, while collecting along the creek bed at Vine-wood park, near Topeka, we came across numbers of *duodecimguttata* by the edge of the water at the foot of a high clay bank on the east side of the stream. They associated with *repanda*, but seemed much inclined to stay upon the bank, where the clay was barely moist, while the latter was restricted to the wet mud.

In the latter part of the month we took a number of *Tetracha virginica* in an open meadow under cow-chips, where they had hidden to pass the day.

Probably the most valuable catch of the season was made at Leona, in Doniphan county, August 10, 11, and 12. While walking through the woods, at about eight o'clock in the morning, we ran across a specimen of *violacea*, the beautiful blue or violet variety of *sexguttata*. It was running along the road, unable to fly because of the morning dampness. We at once set in careful search, and took with ease a few more of the beauties, with thrice as many of the green forms of *sexguttata*. We repeated the performance the two following days with equally good success. During the three days' stay we each took fifty of the forms of *sexguttata*, including a few types, and about ten of the brilliant *violacea*. The percentage here was one blue one to every five of the green, while at Ottawa among nearly three hundred greens not a single blue one was taken, thus indicating that *violacea* is rather a local race. A number of *Tetracha virginica* were taken in the same woods under sticks and chips, and a few more crawling along roads in the evening.

Much time was spent in the fall of 1901, especially October, in collecting the numerous forms of *scutellaris*, *formosa*, and *vulgaris*, amongst the stunted Kafir-corn in the sandy bottom lands of the Kaw. One *vulgaris* taken was so green in color that it was at first mistaken for *graminea*.

During the same month we found our first examples of *purpurea*, and the western forms of *limbalis* and *transversa*, which differ from *amoena* and *splendida* only by the red head and thorax.

In the spring of 1902, during the month of March, a very few more of these abnormal forms were taken in company with the commoner species, *amœna* and *splendida*, on banks of gullies through the prairie. In the month of April over 330 specimens of *scutellaris* and varieties were taken, of which 135 were collected in a single afternoon, April 5. The most productive spot was amongst the grass and plantain at the edge of a sand-drift, in open timber by the river. In this place, as elsewhere, they were common until about the middle of May, when they gradually gave place to the *formosa* varieties.

A number of *duodecimguttata* were found along the foot of a clay bank on the Wakarusa creek, on April 26, in company with *splendida*, and more were taken, as in the previous year, at Vinewood park, on July 10. Because of high water, there was no chance for *ponderosa* to put in its appearance in its accustomed habitat on the sand-bars; but on May 24 they were discovered in abundance on a high sand-bank near the river, in company with *formosa* var. and *repanda*.

One of the most interesting discoveries of the season was made on June 21, in the low sand-hills near the river, northeast of Topeka. The sand in this place is especially white, and at about half-past two I began a search there for *C. lepida*, which had never been taken by day at Topeka. *Formosa* var. was abundant, with now and then a *scutellaris*. Suddenly, while in pursuit of *formosa*, a small white insect arose from under a bunch of grass, flew weakly for a short distance, and alit near another bunch of sand-bur grass, keeping very still. It took close inspection to detect it from the surrounding sand, and it remained still, even under the net, causing some anxiety on the part of the collector. Their habits once learned, it was found that they were more plentiful than at first supposed. Their apparent increase in numbers as evening drew near was not entirely without grounds; for, though at first quite scarce, at four o'clock, as the collector was leaving the grounds, a number of specimens were easily taken on the wing as they arose from the sunny sides of the sand ridges. About forty specimens were taken during the day, one with green head and thorax. Eleven more were taken at the same place on June 24 and four on July 19.

In the month of July seven specimens of *lepida* were taken at the electric lights in the city, with *punctulata*, *cuprascens*, and *macra*. A single specimen of *micans*, the green form of *punctulata*, was similarly taken on July 14, and a *Tetracha virginica* on the 15th.

During the same month *macra* and *cuprascens* were abundant by the river on mud flats caused by the June floods. On July 19 sixty-two specimens of each were taken under such circumstances, and intermingling as they did, a careful investigation on that occasion showed that these closely related species *always* breed true to themselves. A

comparison of the numbers of each species taken during the summer months turns out the following: June, 3 *cuprascens* and 21 *macra*; July, 202 *cuprascens* and 122 *macra*; August, 26 *cuprascens* and 10 *macra*. Many of these were taken at the electric lights.

In the fall of 1902 I had the privilege of taking a trip into western Kansas with my father. We found *cuprascens*, *punctulata* and *micans* at the lights at Dodge City, August 31. The next day, September 1, we found the type *formosa* in abundance in the sand-hills across the river south of town, and the closely-related *venusta* in much less numbers. One or two *scutellaris* were also taken. In an alkali ditch near the river three examples of *fulgida* were found, in company with *vulgaris*. A few *cuprascens* were taken on the sand-bars, and a fine specimen of *micans* was found on a dry road across the prairie on the hills north of town.

At Coolidge, September 2, over forty specimens of *pulchra* were taken on bare clay flats on the high prairie. Near the river two specimens of *nigrocærulea*, the first taken in the state, were found amongst the salt-grass by irrigating ditches. On September 3 a number of *fulgida* were taken on saline spots near a slough in the low prairie; on sand-bars in the Arkansas were taken a *pulchra*, a few *vulgaris*, some very close to *obliquata*, and several each of *venusta*, *ponderosa*, *micans*, and *cuprascens*. The *venusta* chose the fine drifting sand in the hot shelter of the bank, the *vulgaris* and *ponderosa* the flat open sand-bar, and the *micans* and *cuprascens* the wet sand next the water.

On September 4, at Coolidge a single *prasina* was taken in the dried bed of a rain pool, several *micans* at the edge of fresh rain pools, and a number more of *pulchra* on the bare ground near the pools, on the high prairie north of town. At Ness City, September 5, was taken a single *formosa* with markings similar to the variety *manitoba*.

A second trip to western Kansas, toward the last of September, gave the following results:

At Oakley, September 24, *graminea* and *audubonii* were found in plenty along unused roads across the prairie, averaging about three of the former to one of the latter. When frightened they would often rise to a great height, and fly far off with the wind. It was noticed that *audubonii* generally chose depressions in the prairie, where the road was damp and the ground dark. A single specimen each of *pulchra*, *scutellaris*, and *formosa*, and several *micans* and *vulgaris* were also taken. The next day, at Salina, September 25, we found a few *purpurea*, *graminea*, *splendida*, and *amoena*, along an earth-ballasted railroad-track, on the path between the rails.

In an hour's collecting, September 27, at Clearwater, south of Wichita, over sixty specimens of *scutellaris*, all immaculate, were col-

lected in a sandy field near the Ninnescah river. Several *formosa*, *vulgaris* and *repanda* were found along a sandy road by the river, between high weeds. On sand-bars in the stream, *repanda* swarmed by thousands, and several *macra* and *cuprascens*, and one *duodecimguttata*, were taken.

At Wichita, September 28, a number of *purpurea* and *graminea* were found on bare spots in the high prairie; and in a railroad cut east of town the same species, with the addition of *splendida*, *amœna*, and *vulgaris* were taken in numbers.

At Topeka, in March, 1903, a dozen specimens of *purpurea* and *graminea*, a single *audubonii* (a female, in copula with a male *purpureo-graminea*), and two of the western *limbalis*, were found on a clay bank in company with *splendida*.

On the 19th of May my chum and I had the good fortune to accompany Dr. F. H. Snow on a trip to Englewood, Clark county, Kansas, where six weeks were devoted entirely to collecting insects.

During the first two weeks there we found *fulgida* in abundance on bare spots along a salt creek, where it was common until the last week of June, being gradually replaced by *circumpicta*. Several specimens of *denverensis*, the bright green form of *splendida*, were taken in May on a clay bank; and three or four *graminea*, with a single *audubonii*, were found on the prairie; while *scutellaris* and *formosa* were quite common in May and early June in sandy localities. With the latter was taken a specimen of *venusta*. It might be remarked that the *scutellaris* and *formosa* were nearly all found along low, sandy roads, practically none being seen in the barren sand-hills, where one would most expect to find them.

One of the best discoveries of the season was the finding of *C. knausii*, a variety of *nevadica* recently named for a well-known Kansas collector by Mr. Chas. W. Leng, in his "Revision of the N. A. Cicindelidæ." On the 6th of June this species appeared along the muddy margins of the creek, becoming more abundant each day, until inside of a week it fairly swarmed. A few green or blue specimens were taken, at an average of about one green to a hundred or more of the brown.

In a week's time after the appearance of *knausii*, *apicalis*, W. Horn's variety of *togata*, was found on a broad alkali flat about a mile from the creek. This also became very common; and on June 20, a week after the appearance of *apicalis*, the first specimens of *circumpicta* were taken in company with it on the white saline flat. By June 26 *circumpicta* was the more abundant of the two. It appeared in two forms, the green and the cupreous, which were about equal in abundance. The intense heat and dazzling sunlight reflected by the smooth white ground made it difficult to collect these two species.

Moreover, both were swift runners, and *apicalis* was quite hard to see because of its light color. *Knausii* was sometimes found near the center of the flat, where the ground was moist, and *fulgida* was very common along the margin, amongst the buffalo-grass. During the last few days of June *apicalis* and *circumpicta* both appeared along the salt creek, where *fulgida* had swarmed in May and early June.

Vulgaris, *repanda*, *punctulata* and *micans* were more or less common everywhere about Englewood on bare ground. On sand-bars in the Cimarron river *ponderosa* and *knausii* were quite plentiful, though the latter seemed more at home along the muddy creeks and ponds. With these a few specimens of *cuprascens* were also taken.

A second Kansas University entomological expedition for 1903 made collections in Arizona during the months of July and August, and, though very few cicindelids were taken as compared with the preceding trip, a few are well worth mention.

On July 21 a number of the beautiful green form of *sperata* were taken, during a short delay on the way, at Caddoa, Colo. The first one was found on the dry prairie with *pulchra* and *micans*. A few more were taken near wet spots along a road by the river, in company with *micans*. The most of the specimens, however, were found in a large alkali mud-hole back of the station. The depression was about six feet deep, and three or four rods long, with a floor of perfectly white alkaline mud half an inch thick. Near the center were several shallow pools of water, and around these ran the green *sperata*, conspicuous amongst the more somber brown forms of *knausii*, which greatly outnumbered them. The finding of these two species together was rather unusual; but still more striking was the total absence of the brown or cupreous forms of *sperata*, which usually predominate, and in contrast the absence of the blue or green forms of *knausii*.

Later, during the night, while the train changed crews at Albuquerque, a number of the normal brown form of *sperata*, and one cupreous, were picked up at the arc lights in front of the depot.

At Martinez, or Congress Junction, Ariz., 3000 feet a. t., where our journey ended, we took two very interesting species of "tigers," an aberrant green form of *nigrocærulea*, and the dainty little desert-loving *lemniscata*. Both kinds occurred by the margins of ponds, the one preferably on very wet mud, the other on any damp soil.

Nigrocærulea was the less common of the two; and though taken in numbers on July 24 and 25, by the 1st of August the pond around which it had occurred most abundantly was nearly dried up, and no more of the desired beetles were to be found. This remarkable insect somewhat perplexed the collectors. The females were quite robust, of a rather dull green color, touched with brown on the head and thorax, and with brilliant opalescent green reflections on the elytra,

exhibiting many of the characteristics of *nigrocærulea*; the males were narrower, smaller, and more convex, with the elytra somewhat polished and lacking the opalescent reflections, thus placing them closer to the western form of *micans*. The specimens also varied in markings: some were almost immaculate; some had only apical and median dots; others had humeral, post-humeral, marginal and median dots, and apical lunule. One male was taken with complete apical and humeral lunules and marginal line, all very much dilated, the last broadly confluent with the humeral lunule, forming a nearly complete marginal band, after the manner of *C. bowditchii* Leng. I sent some specimens of it to Mr. Edward D. Harris, of New York city, and he wrote the following regarding it, under date of September 29, 1903:

"Your box with the specimens came safely. The *lemniscatas* are little beauties, and the *nigrocæruleas* (if they are such) very interesting. I have spent a number of hours over these last, and must confess my want of confidence in placing them. Apparently it is a local race of Leconte's insect. My own specimens of *nigrocærulea* (= *robusta* Leng; for Leng admits to me that the name is a synonym) are nine in number, thus: Two from Robinson, Colo., dark indigo blue, one immaculate, one with apical dot. Four from La Junta, Colo.; two blue immaculate; one blue, with a green suffusion, large apical lunule entire, marginal and humeral dots; one green, apical dot abnormally prolonged. One from Bent county, Colorado, yellowish green immaculate. Two from Alpine, Tex.; one black with indigo reflections, immaculate; one dark bronze green, immaculate. The two specimens you send differ from the above in two respects only, so far as I can discover—first, in the form, being not so robust in the outline of the elytra toward the apex, and second in preserving a sharply-developed metallic luster of head and thorax, absent in all my specimens of the Leconte insect. Both respects bring it closer to *micans*; but the pilosity is that of *nigrocærulea*, rather than of the *punctulata* group. With your large series it would be a very interesting study to see just how far the differences extend. One of your specimens is immaculate; the other has obscurely-marked marginal spots, in position and shape like those of *nigrocærulea*. I shall be greatly interested to know where Professor Snow places it, and how much importance, if any, he attaches to its differences."

Then, under date of November 2, he writes: "I received promptly both your boxes, the first containing five of the very interesting and valuable variety of *nigrocærulea*, safely and in the best of condition. I have seized the opportunity of another study of the Arizona beetle, with the seven specimens to refer to. They are all very close to one form, indicative of the existence of a very well-defined local variety, separable instantly from the Fort Bent insect, and from that of Al-

pine, Tex., which Leng called robusta. I look to its varietal designation by some one of your Western entomologists. I thank you very much for the opportunity of possessing so interesting an insect."

None of the lemniscata were seen around the shallow and muddy "nigrocærulea pond"; but on the steeper banks of another pond near by, where only two or three nigrocærulea had been previously taken, they were found in profusion. They are very inconspicuous insects, very much like small mud-flies as they arise from the water's edge, fly low for a few feet, and alight as abruptly as they arise. They were very common throughout the week that we were at Martinez and came quite frequently to the lamplight at night. A few were taken by light in the middle of the broad Martinez wash, indicating that they must have occurred on the dry sand as well.

The month of August was spent collecting on the Bill Williams Fork, fifty miles westward, at a point about eight miles south of the Rio Santa Maria, elevation 1000 feet. Here cicindelids were unusually scarce. Two specimens of lemniscata only were taken. *Tetracha carolina* were found commonly under stones along the stream, in company with *Brachynus*, *Oodes*, and other carabids. They are exceedingly swift runners, gaining a yard or more before the stone were fairly turned over. Several fruitless efforts were made to find them hunting for food in the evening, as *virginica* is so often found in the East. The remains of a green *Cicindela*, presumably *maricopa*, were found buried in the sand; but we left a little too early (September 4) to greet its fall appearance.